Building a hiPSC-based biopacemaker

Grant Award Details

Building a hiPSC-based biopacemaker

Grant Type: Quest - Discovery Stage Research Projects

Grant Number: DISC2-12263

Project Objective: To bioprint a biopacemaker for allogeneic use, using hiPSC-derived pacemaking cardiomyocytes (PCMs), hiPSC-derived epicardial fibroblasts (FBs) and extracellular matrix proteins (ECMs), and to test its functionality in vitro (pacemaking) and in vivo (longevity under cyclic strain in a heterotopic model)

Investigator:

Name:	Deborah Lieu
Institution:	University of California, Davis
Type:	PI

Disease Focus: Heart Disease

Human Stem Cell Use: iPS Cell

Award Value: $1,260,827

Status: Pre-Active

Grant Application Details

Application Title: Building a hiPSC-based biopacemaker

Public Abstract:

Research Objective

A proof-of-concept biopacemaker constructed by bioprinting hiPSC-derived pacemaking cells and support cells based on the blueprint of the native pacemaking tissue of a large mammalian heart.

Impact

A hiPSC-based biopacemaker bioprinted using a design of the native pacemaking tissue in the heart, with protective electrical and mechanical insulations, can better sustain the pacemaking function.

Major Proposed Activities

- To make a template for bioprinting hiPSC-based biopacemaker based on the native pacemaking tissue of a large mammalian heart
- To develop two bioinks composed of hiPSC-derived cardiac cells for bioprinting biopacemakers
- To optimize the printing conditions for the bioprinter
- To characterize and assess the function of bioprinted biopacemakers
- To test the longevity of the biopacemakers subjected to cyclic stretch in a small animal

Statement of Benefit to California:

Over 350,000 patients a year in the U.S. require an electronic pacemaker to restore their heart rhythm. The annual healthcare burden amounts to $20 billion. Repeated surgeries to replace battery and electrical parts generate additional costs and suffering for patients. A bioprinted hiPSC-based biopacemaker can overcome limitations associated with electronic pacemakers, improve the quality of life for the pacemaker recipient, and reduce the cumulative health care costs.
